TITLE

MICROORGANISM RESISTANT SHINGLE AND METHOD OF MAKING SAME

Inventors: David P. Aschenbeck and Russell M. Potter

TECHNICAL FIELD

[0001] This invention relates to roofing shingles. More particularly, this invention relates to an improved microorganism resistant roofing shingle and a method of making such a roofing shingle.

BACKGROUND OF THE INVENTION

[0002] A common method for the manufacture of asphalt shingles is the production of a continuous strip of asphalt shingle material followed by a shingle cutting operation which cuts the material into individual shingles. In the production of asphalt shingle material, a substrate such as an organic felt or a glass fiber mat is passed through a coater containing liquid asphalt to form a tacky asphalt coated strip. Subsequently, the hot asphalt coated strip is passed beneath one or more granule applicators which apply the protective surface granules to portions of the asphalt coated strip to form a granule coated sheet. The granule coated sheet is cooled and subsequently cut into individual shingles.

[0003] The manufacture of shingles from such an asphalt coated strip generally involves dispensing at least two different types of granules. "Headlap" granules, which are relatively low in cost and primarily serve the functional purpose of protecting the underlying asphalt material, are applied to a shingle at regions which will ultimately be covered by adjacent shingles when installed upon a roof. Colored granules or other "prime" granules are relatively expensive and are

applied to the shingle at regions which will ultimately be visible when the shingles are installed upon a roof. Prime granules are disposed upon the asphalt strip for both the functional purpose of protecting the underlying asphalt strip and for the purpose of providing an aesthetically pleasing roof. In a typical shingle manufacturing process, the continuous asphalt coated strip may be sufficiently wide to allow for each predetermined length of the strip to be cut into several roofing shingles of such predetermined length. A traditional size for a roofing shingle is three feet by one foot. For example, some shingle manufacturing plants use an asphalt coated strip which is sufficiently wide to allow three, one foot wide shingles of a predetermined length to be cut from each such length of asphalt coated strip. However, other plants use an asphalt coated strip which is sufficiently wide to allow four, five, or six, one foot wide shingles to be cut from each length.

[0004] In the manufacturing process, the asphalt coated strip is conceptually divided into an equal number of prime lanes, and headlap lanes. The prime lanes receive an application of prime granules while the headlap lanes receive an application of headlap granules. In a three shingle wide configuration, the asphalt coated strip therefore is divided lengthwise into six lanes comprising three headlap lanes and three prime lanes. When a desired length of the asphalt coated strip is cut into three shingles, each shingle will be comprised of a length of headlap lane and the adjacent length of prime lane.

[0005] One problem commonly facing homeowners and others having asphalt shingled roofs, among other types of roofs, has been the growth of algae and fungus on the exposed surfaces of the roof. On a roof covered with asphalt shingles, this problem manifests itself as severe discoloration of the exposed shingle surfaces. Although this algae and fungus growth is especially prevalent in the Gulf Coast area of the United States and other warm and humid climates, it has also been found to occur in the northern regions of the United States. The

discoloration generally becomes visibly apparent during the second or third year after the roofing shingles have been applied, beginning as dark spots which develop into dark streaks which eventually cover a majority of the roof. For aesthetic and sun reflective purposes, granules disposed upon the exposed or prime portions of roofing shingles are often white or light-colored and such fungus or algae or other microorganism growth on a light-colored or white shingle is particularly noticeable and unsightly.

[0006] To combat the problems associated with the growth of fungus, algae, and other microorganisms upon the exposed surfaces of roofing shingles, it is generally known to include anti-microorganism granules upon the exposed surfaces of the shingles. The anti-microorganism granules can be any desired anti-microorganism granules, such as for example, copper and/or other metals such as zinc, or particles of metallic copper or zinc. As is known, when exposed to moisture, the anti-microorganism granules, such as copper granules, are oxidized and slowly release or leach ions which have a toxic effect on microorganisms such as algae and fungi, and thereby inhibit their growth.

[0007] To minimize costs and to maximize algae and fungus fighting effectiveness, it is generally desirable to have a predetermined percentage of the anti-microorganism granules disposed upon the prime surface of each shingle. Such granules have heretofore been mixed with the prime granules to this predetermined percentage by weight or volume and applied with the ordinary prime granules to the prime lanes of the strip of asphalt covered material. Such anti-microorganism granules however, can become embedded or enveloped in the asphalt of the asphalt coated strip. As used herein "enveloped" is defined as buried or substantially surrounded by asphalt. Moisture cannot reach the enveloped anti-microorganism granules, and the enveloped anti-microorganism granules therefore cannot release anti-microorganism ions. The enveloped anti-

microorganism granules therefore do not contribute to the desired algae and fungus resistance.

SUMMARY OF THE INVENTION

[0008] The present invention relates to a method of manufacturing a roofing shingle including coating a continuously supplied shingle mat with roofing asphalt to make an asphalt coated sheet. A first portion of granules is applied onto the asphalt coated sheet, wherein the first portion contains substantially no anti-microorganism granules. A second portion of granules is applied over the first portion of granules, wherein the second portion of granules comprises granules and anti-microorganism granules. The granules and anti-microorganism granules which are not adhered to the asphalt coated sheet are the removed.

[0009] The invention also relates to a roofing shingle including an asphalt coated sheet. A first portion of granules is adhered to the asphalt coated sheet, wherein the first portion contains substantially no anti-microorganism granules. A second portion of granules is adhered to the asphalt coated, wherein the second portion of granules comprises granules and anti-microorganism granules. The asphalt of the asphalt coated sheet envelops a predetermined percentage of the anti-microorganism granules.

[0010] Other advantages of this invention will become apparent to those skilled in the art from the following detailed description of the invention, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] Fig. 1 is a schematic elevational view of a portion of an apparatus for making shingles according to the method of the invention.

[0012] Fig. 2 is a schematic plan view of a portion of an asphalt-coated sheet, showing a roofing shingle, made according to the method of the invention.

[0013] Fig. 3 is an enlarged schematic cross-sectional elevational view of the prime region of the roofing shingle illustrated in Fig. 2.

DETAILED DESCRIPTION OF THE INVENTION

[0014] Composite shingles, such as asphalt shingles, are a commonly used roofing product. Asphalt shingle production generally includes feeding a base material from a roll fed downstream and coating it first with a composite material, then a layer of granules. The base material is typically made from a fiberglass mat provided in a continuous shingle membrane or sheet. It should be understood that the base material can be any suitable support material.

[0015] The composite material, such as an asphalt material, is added to the continuous shingle membrane for strength and improved weathering characteristics. It should be understood that the composite material can be any suitable material, preferably low in cost, durable, and resistant to fire. The layer of granules is typically applied with one or more granule applicators, such as pneumatic blenders, to the asphalt material covering the continuous shingle membrane. The pneumatic blender is a type of granule applicator known in the art. The granules shield the asphalt material from direct sunlight, offer resistance to fire, and provide texture to the shingle. The granules can be colored in a way known in the art, preferably before being applied to the continuous shingle membrane. The granules are preferably applied to the continuous shingle membrane in color patterns to provide the shingles with an aesthetically pleasing appearance. As will be explained in detail herein, anti-microorganism granules, such as copper granules, can be added to the granules to inhibit the growth of algae, fungus, and/or other microorganisms.

[0016] The description and drawings disclose an improved method for manufacturing an asphalt shingle having anti-microorganism granules. Referring now to the drawings, there is shown in Fig. 1 an apparatus 10 for manufacturing an asphalt-based roofing material according to the invention. The illustrated manufacturing process involves passing a continuous sheet in a machine direction (indicated by an arrow 12) through a series of manufacturing operations. The sheet usually moves at a speed of at least about 200 feet/minute (61 meters/minute), and typically at a speed within the range of between about 450 feet/minute (137 meters/minute) and about 800 feet/minute (244 meters/minute).

[0017] In a first step of the manufacturing process, a continuous sheet of substrate or shingle mat 14 is payed out from a roll (not shown). The substrate can be any type known for use in reinforcing asphalt-based roofing materials, such as a nonwoven web of glass fibers. The shingle mat 14 is fed through a coater 16 where a coating of asphalt 18 is applied to the shingle mat 14. The asphalt coating can be applied in any suitable manner. In the illustrated embodiment, the mat 14 is submerged in a supply of hot, melted asphalt 18 to completely cover the mat 14 with a tacky coating of asphalt 18. However, in other embodiments, the asphalt coating could be sprayed on, rolled on, or applied to the sheet by other means. Typically the asphalt material is highly filled with a ground stone filler material, amounting to at least about 60 percent by weight of the asphalt/filler combination.

[0018] The resulting asphalt-coated sheet 20 is then passed beneath a series 22 of granule hoppers or blenders 24, 26, 28, and 30 for dispensing granules to an upper surface of the asphalt-coated sheet 20. The specific purpose of each blender 24, 26, 28, and 30 will be explained in detail herein. The granule blenders 24, 26, 28, and 30 can be of any type suitable for depositing granules onto the granule covered sheet. An example of a granule blender is a granule blender of the type disclosed in U.S. Patent No. 5,599,581 to Burton et al., which is hereby incorporated by reference, in its entirety. Additionally, a granule valve such as the

granule valve disclosed in U.S. Patent No. 6,610,147 to Aschenbeck may also be used. U.S. Patent No. 6,610,147 to Aschenbeck is also incorporated by reference in its entirety. Although 4 granule blenders 24, 26, 28, and 30 are shown in the exemplary embodiment illustrated in Fig. 1, any suitable number and configuration of granule blenders can be used.

[0019] For example, a series of two blenders can be used, wherein the granule blender 24 can be used to deposit accent colored granules or partial blend drops on the asphalt-coated sheet 20, and the granule blender 26 can be used to apply background granules, thereby defining a granule covered sheet 32. A preferred technique for assuring a generally sharp demarcation between zones of different colors is disclosed in U.S. Patent No. 5,405,647 to Grubka et al., which is hereby incorporated by reference in its entirety.

[0020] As is well known in the art, blend drops applied to an asphalt-coated sheet are often made up of granules of several different colors. For example, one particular blend drop that is supposed to simulate a weathered wood appearance might actually consist of some brown granules, some dark gray granules and some light gray granules. When these granules are mixed together and applied to the sheet in a generally uniformly mixed manner, the overall appearance of weathered wood is achieved. For this reason, the blend drops are referred to as having a color blend, which gives an overall color appearance, and this overall appearance may be different from any of the actual colors of the granules in the color blend. Also, blend drops of darker and lighter shades of the same color, such as, for example, dark gray and light gray, are referred to as different color blends rather than merely different shades of one color.

[0021] After all the granules are deposited on the asphalt-coated sheet 20, the granule covered sheet 32 is turned around a slate drum 34 to press the granules into the asphalt coating and to temporarily invert the sheet so that the excess granules will fall off and will be recovered and reused. The granule covered sheet

32 is subsequently fed through a rotary cutter (not shown) that cuts the granule covered sheet 32 into individual shingles.

[0022] The asphalt-coated sheet 20 is shown in more detail in Fig. 2. As shown, the asphalt-coated sheet 20 comprises six distinct regions or lanes including three headlap lanes h1, h2, and h3, and three prime lanes p1, p2, and p3. An exemplary roofing shingle is shown by a phantom line 36 and may be cut from asphalt-coated sheet 20 as shown. In this manner, three roofing shingles of any length desired may be cut from each such length of asphalt-coated sheet 20. Each shingle 36 would contain one headlap lane h1, h2, or h3, and one respective adjacent prime lane p1, p2, or p3. Accordingly, the shingle 36 includes a headlap region 38 and a prime region 40.

[0023] The headlap region 38 of the shingle 36 is that portion which is covered by adjacent shingles when the shingle 36 is ultimately installed upon a roof. The prime region 40 of the shingle 36 is that portion which remains exposed when the shingle 36 is ultimately installed upon a roof. It is upon the prime region 40 therefore, that the growth of fungus, algae, or other such microorganisms may produce an undesirable and unsightly appearance.

[0024] The shingle 36 is preferably cut from the asphalt-coated sheet 20 to be three feet long by one foot wide. The shingle 36 also preferably includes two cut-out regions 40 which define three tabs 44. It will be apparent to one skilled in the art that the asphalt-coated sheet 14 may be a wide variety of widths to allow different numbers of shingles to be cut therefrom. For example, some roofing shingle manufacturing plants use an asphalt-coated sheet (not shown) which is sufficiently wide to allow four, one foot wide shingles to be cut therefrom. Such a wider asphalt-coated sheet would include an additional headlap region, and an additional prime region. One skilled in the art will also recognize that roofing shingles of different sizes, i.e. roofing shingles having different lengths and/or widths, may be cut from the asphalt-coated sheet 20.

[0025] Referring again to Fig. 1, the asphalt-coated sheet 20 is first caused to pass, using means known in the art, beneath a first blender 24. The blender 24 deposits a first portion of granules 46 onto the prime lanes p1, p2, and p3 of the asphalt-coated sheet 20. The blender 24 can be any desired blender as are well known in the art. Preferably, the blender 24 deposits a substantially uniform "curtain" of the first portion of granules 46 over the prime lanes p1, p2, and p3 of the asphalt-coated sheet 20 to uniformly distribute the granules 46 upon the prime lanes p1, p2, and p3. Preferably, the first portion of granules 46 comprise background granules as are known in the art.

[0026] More preferably, the first portion of granules 46 contain substantially no anti-microorganism granules. As used herein, the phrase "substantially no anti-microorganism granules" shall be understood to mean that the first portion of granules contains within the range of from about 0.0 percent to about 1.0 percent by weight of anti-microorganism granules.

[0027] The first blender 24 receives a supply of the granules 46 from a source using any desired means, many of which are known in the art. The output from the blender 24 can be controlled by any of several known means, including operating an output opening or gate 48 at the output of the blender. The output gate 48 of the first blender 24 preferably has a first output orifice designed to apply the granules 46 to the prime lanes p1 and p2, and a second output orifice designed to apply the granules 46 to the prime lane p3.

[0028] Alternately, a weigh scale or a loss-in-weight scale may be used to supply the granules 46 into first blender 24 at a predetermined rate to thus control the output of the granules 46 from first blender 24. A preferred method of metering out the granules is with a linear granule valve using a reciprocating gate operated by means of a servo motor, as disclosed in U.S. Patent No. 6,610,147 to Aschenbeck. In such an arrangement, the input supply of granules 46 may depend, for example, upon the speed at which asphalt-coated sheet 20 moves

beneath first blender 24. The first blender 24 may be adapted with any other suitable means known in the art to control the output of granules 46 therefrom.

[0029] According to the method of the invention, substantially all of the first portion of granules 46 are completed enveloped by the asphalt of the asphalt-coated sheet 20. It will be understood that the phrase "substantially all" is defined as within the range of from about 70 percent to about 80 percent of the first portion of granules 46. Preferably, about 75 percent of the first portion of granules are completed enveloped by the asphalt of the asphalt-coated sheet 20.

[0030] Subsequent to the first portion of granules 46 being deposited onto the prime lanes p1, p2, and p3 of the asphalt-coated sheet 20, the asphalt-coated sheet 20 passes beneath a second blender, such as the blender 26. The blender 26 preferably dispenses a second portion of granules 50 onto the prime lanes p1, p2, and p3 using means known in the art. Preferably, the second portion of granules 50 includes prime granules and anti-microorganism granules.

[0031] The blender 26 is substantially identical to the blender 24, and is adapted with any suitable means for controlling the quantity of granules 50 dispensed therefrom, such as an output gate 52. Preferably, an output from the blender 26 is controlled such that the anti-microorganism granules constitute a predetermined percentage of the total volume of all granules in the second portion of granules 50 which ultimately adhere to the asphalt-coated sheet 20. More preferably, the predetermined percentage of the anti-microorganism granules is within the range of from about 6 percent to about 12 percent of the total volume of all granules in the second portion of granules 50 which ultimately adhere to the asphalt-coated sheet 20. For example, if a total of thirty pounds (30 lbs.) of granules adhere to each 100 square feet of a prime lane p1, p2, and p3, approximately 9 percent or 2.7 pounds of these granules would be anti-microorganism granules. It will be appreciated however, that the amount of anti-microorganism granules may vary.

[0032] Preferably, the application the first portion of granules 46 onto the asphalt-coated sheet 20 is controlled so that the first portion of granules 46 constitutes a first predetermined percentage of the total volume of all granules in the first and second portions of granules which ultimately adhere to the asphalt coated sheet. More preferably, the first predetermined percentage is within the range of from about 20 percent to about 50 percent of the total volume of all granules which ultimately adhere to the asphalt coated sheet.

[0033] Numerous types of prime granules are well known in the art and may include, for example, colored granules. The blender 26 receives a supply of prime granules from a source by any of the numerous means as are well known in the art. If desired, the blender 26 can dispense several different colors or shades of prime granules at predetermined intervals on the prime lanes p1, p2, and p3, to provide a more aesthetically pleasing and textured appearance to an installed roof.

[0034] Anti-microorganism granules are known in the art and are preferably designed to inhibit the growth of algae, fungus, and/or other microorganisms. Anti-microorganism granules may be similar in appearance and composition to ordinary roofing granules as are known in the art or may be another particulate substance such as, for example, small pieces of metallic copper or zinc. Thus, the term granule, as used herein, includes any suitable particulate or particle-like material. The anti-microorganism granules may be made entirely from copper or contain copper or copper compounds. Anti-microorganism roofing granules are available commercially from the Minnesota Mining and Manufacturing Company, St. Paul, Minn., also known as 3M.

[0035] Subsequent to the second portion of granules 50 being deposited onto the prime lanes p1, p2, and p3 of the asphalt-coated sheet 20, the asphalt-coated sheet 20 passes beneath a third blender, such as the blender 28. The blender 28 preferably dispenses a third portion of granules 53 onto the prime lanes p1, p2, and

p3 using means known in the art. Preferably, the third portion of granules 53 includes the background granules 46.

[0036] The blender 28 is substantially identical to the blender 24, and is adapted with any suitable means for controlling the quantity of the granules 46 dispensed therefrom, such as an output gate 54. Preferably, an output from the blender 28 is controlled such that a quantity of the background granules 46 sufficient to adhere to any portion of the asphalt-coated sheet 20 not already covered by granules dispensed from the blenders 24 and 26.

[0037] The application of headlap granules 56 to the headlap lanes h1, h2, and h3 of the asphalt-coated sheet 20 preferably occurs after the application of the first, second, and third portions of granules 46, 50, and 53, respectively, although it may occur before such application. The application of the headlap granules 56, which are lower in cost and less aesthetically pleasing than prime granules or background granules 46, preferably occurs when the asphalt-coated sheet 20 passes beneath a backfall hopper or feeder 30. The hopper or feeder 30 deposits headlap granules 56 onto the headlap lanes h1, h2, and h3 of the asphalt-coated sheet 20. Preferably, the hopper or feeder 30 is a fluted roll/gate hopper having a gated output orifice 58. In addition to receiving backfall headlap granules 56 and backfall prime granules, the feeder 30 preferably receives additional headlap granules 56 from a source by any of the numerous means as are well known in the art.

[0038] The slate drum 34 is designed to cause any excess non-adhered prime granules and headlap granules 56, to be removed from the asphalt-coated sheet 20 and to be deposited into the feeder 30 for re-application to the asphalt-coated sheet 20. By continuously depositing an excess of granules onto the asphalt-coated sheet 20, the asphalt-coated sheet 20 is more likely to be completely covered with granules.

[0039] The second portion of granules 50, comprising both prime granules 56 and anti-microorganism granules, are more expensive than headlap granules. Further, it is undesirable to have any backfall headlap granules 56 deposited onto the prime lanes p1, p2, and p3 of the asphalt-coated sheet 20. Accordingly, the feeder 30 is preferably designed to keep the backfall headlap granules 56 separate from backfall granules from the second portion of granules 50. In this manner, the backfall headlap granules 56 may be re-applied to the headlap lanes h1, h2, and h3 of the asphalt-coated sheet 20, and backfall granules from the second portion of granules 50 may be reapplied to the prime lanes p1, p2, and p3 of the asphalt-coated sheet 20.

[0040] A schematic illustration of the shingle 36 is shown at Fig. 3. The shingle 36 includes the asphalt-coated sheet 20. A first portion of granules 46 is adhered to the asphalt coated-sheet 20. Preferably, as describe herein, the first portion of granules contains substantially no anti-microorganism granules.

[0041] A second portion of granules 50 is also adhered to the asphalt coated sheet 20. The second portion of granules 50 comprises includes prime granules and anti-microorganism granules. Preferably, the asphalt of the asphalt-coated sheet 20 envelops a predetermined percentage of the anti-microorganism granules. More preferably, the predetermined percentage of the anti-microorganism granules enveloped by the asphalt of the asphalt-coated sheet 20 is within the range of from about 0.0 percent to about 5.0 percent.

[0042] As shown schematically in Fig. 3, substantially all of the first portion of granules 46 are completed enveloped by the asphalt 18 of the shingle 36. It will be appreciated that the phrase "substantially all" is defined as within the range of from about 70 percent to about 80 percent of the first portion of granules 46. Preferably, about 75 percent of the first portion of granules are completed enveloped by the asphalt of the asphalt-coated sheet 20.

[0043] It will be also appreciated that some of the second portion of granules 50 can be adhered to the asphalt-coated sheet 20 below (as viewed in Fig. 3) at least some the first portion of granules 46. Preferably, however, most of the second portion of granules 50 are adhered to the asphalt-coated sheet 20 relatively above (as viewed in Fig. 3) the first portion of granules 46, so as to be visible when the shingle 36 is installed on a roof.

[0044] When the shingle 36 is exposed to moisture, the anti-microorganism granules, such as copper granules within the second portion of granules 50, are oxidized and slowly release copper ions. The copper ions have a toxic effect on microorganisms such as algae and fungi, and thereby inhibit their growth.

[0045] Alternately, the anti-microorganism granules, such as copper granules, can be sufficiently large such that when applied to the asphalt-coated sheet 20, the copper granules do not become completely enveloped by the asphalt 18 of the asphalt-coated sheet 20. For example, when the asphalt 18 of the asphalt-coated sheet 20 has a thickness, such as about 1.2 mm, copper granules having a diameter within the range of from about 1.2 mm to about 1.7 mm can be used. When copper granules having such a diameter are combined with prime granules and deposited on the asphalt-coated sheet 20, substantially none of the copper granules are enveloped by the asphalt 18. A shingle having such copper granules therefore ensures that most of the copper granules are exposed to moisture when the shingle is installed on a roof. Further, it will be appreciated that when such copper granules are used, the application of the first portion of granules 46, as herein described, can be omitted if desired.

[0046] Although the invention has been described in the context of a three-tabbed shingle 36, it will be appreciated that the method of the invention can be applied to any type of shingle, such as a laminated shingle.

[0047] The principle and mode of operation of this invention have been described in its preferred embodiments. However, it should be noted that this

invention may be practiced otherwise than as specifically illustrated and described without departing from its scope.